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Experiments and simulations of the interaction of high velocity granular slugs with structures

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ABSTRACT

Shallow buried landmine explosions cause the ejection of a high velocity granular spray that impinges on structures. An understanding of the flow pattern of the ejected soil and its interaction with the target is needed for the development of protective systems. Here, we consider an idealized problem of a granular slug impinging on a structure to gain a basic understanding of the so-called fluid–structure interaction between the flowing granular medium and the impacted structure. This interaction is investigated both numerically using a coupled discrete particle – finite element method and laboratory scale experiments. Experiments and simulations are reported to investigate the effects of (i) granular properties such as interparticle stiffness, friction etc.; (ii) inclination of target relative to the oncoming slug; and (iii) friction between the target and particles; on the granular flow and the momentum transfer from the granular slug to the target. The findings are used to motivate how protective structures can be improved to mitigate the blast from landmine explosions.